Gunter, Jason

From: Nations, Mark [mnations@doerun.com]
Sent: Tuesday, January 14, 2014 8:35 AM
To: Gunter, Jason
Subject: RE: Leadwood Progress Report
Attachments: Inspection Report 10.16.2013.docx; DrawingsC-01-C-05.pdf

Categories: Red Category

Jason, attached is the inspection with drawings. As for LW and RM, I was wondering when you planned on being on site.

From: Gunter, Jason [mailto:gunter.jason@epa.gov]
Sent: Monday, January 13, 2014 11:25 AM
To: Nations, Mark
Cc: Yingling, Mark; Wohl, Matthew; robert.hinkson@dnr.mo.gov; brandon.wiles@dnr.mo.gov; Sanders, Amy B.; Cummings, Mark; Ty Morris (TMorris@barr.com)
Subject: RE: Leadwood Progress Report

Hi Mark,

Was wondering when we will receive the information on the inspection of the Leadwood Decant Tower. Also, are there any developments on the treatment cells for Leadwood?

Thanks,

Jason Gunter
Remedial Project Manager
US EPA Region 7
11201 Renner Blvd.
Lenexa, KS. 66219
Office: 913-551-7358
Cell: 913-302-9144

From: Nations, Mark [mailto:mnations@doerun.com]
Sent: Monday, January 13, 2014 10:34 AM
To: Gunter, Jason
Cc: Yingling, Mark; Wohl, Matthew; robert.hinkson@dnr.mo.gov; brandon.wiles@dnr.mo.gov; Sanders, Amy B.; Cummings, Mark; Ty Morris (TMorris@barr.com)
Subject: Leadwood Progress Report

Jason,
Attached is the December report.
Let me know if you have questions.
Mark

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Superfund
0402

Leadwood Mine Tailings Impoundment

Inspection of Leadwood Dam Decant Structure

Prepared for
The Doe Run Company

October 2013

Inspection of Leadwood Dam Decant Structure

October 2013

Table of Contents

List of Appendices

Table 1 – Concentrations of Zinc and Lead (Total and Dissolved)

Date	General Site Condition	Location	Parameter (mg/L unless otherwise specified)				
			Flowrate (gpm)	Zinc-Dissolved	Zinc-Total	Lead-Dissolved	Lead-Total
4/10/2012	Normal	LW-Outlet Str	250	0.153	0.166	0	0
		LW-W Mud Pond	Stagnant	0.0384	0.0688	0	0
		LW-Splway Cul	340	0.113	0.123	0	0
		LW-Dec Cul	450	0.156	0.198	<.04	0.07
		LW-E Mud Pond	8 (Pond Eff.)	0.0197	0.0228	0	0
5/3/2012	Dry	LW-Outlet Str	25 (est.)	0.192	0.23	0.0064	<.04
		LW-W Mud Pond	Stagnant	0.0588	0.0722	0.016	0.028
		LW-Splway Cul	9	0.147	0.184	<.04	0.019
		LW-Dec Cul	140	0.184	0.29	0.012	0.146
		LW-E Mud Pond	8 (Pond Eff.)	0.0611	0.0778	0.01	0.025
5/30/2012	Very Dry	LW-W Mud Pond	Stagnant	0	0.026	0.0041	0.0432
		LW-W Trib	Low	0.0712	0.202	0.0127	0.322
		LW-Dec Cul	140 (est.)	0.245	0.426	0.014	0.378
9/28/2012	Very Dry	LW-W Trib	2 (est.)	1.27	1.4	<.04	0.086
		LW-W Trib-b	8 (est.)	1.41	1.66	<.04	0.501
		LW-Dec Cul	12 (est.)	2.14	2.34	0.041	0.098

Figure 1 – Sampling locations; "LW-Outlet Str" is upstream of all other sampling locations, while "LW-Dec Cul" is downstream of all other sampling locations

For this reason, Barr is evaluating options to remediate the decant structure to reduce the infiltration of seepage from the surrounding tailings and minimize metals contamination in the discharge from the decant tower. As part of this effort, Barr completed a detailed structural inspection of the inside of the tower and culvert, to determine the overall condition of the concrete, identify any specific problem areas, and to obtain a better understanding of the potential sediment and groundwater transport that may be occurring so that renovation plans could be reliably developed. This inspection occurred on August 29, 2013.

This report details the findings of the inspection, and gives preliminary overviews of potential design options for the decant tower structure, as well as potential future investigative measures.

1.3 Inspection Description and Site Preparation

The inspection occurred in two phases. In the first phase, the decant tower occurred using a boom truck equipped with a man basket, that lowered two Barr personnel down each shaft to take measurements and make observations. In the second phase, the decant culvert was inspected by two Barr personnel who walked the length of the decant tower culvert to take measurements and make observations.

Preparation for the inspection included blocking surface flow to the decant tower using a clay berm, developing fall protection measures, and laying stone surfaces nearby for equipment use.

- The orange residual discoloration is thought to be caused from the presence of iron reducing bacteria that thrive off the oxygen from the iron oxidation process. This discoloration is known to occur when water with a high dissolved iron concentration from an anaerobic environment surfaces into an aerobic environment creating iron oxide (Fe_2O_3). This phenomenon has been observed in other locations on the Leadwood site, particularly at the toes of earthen embankments where groundwater is known to surface. The presence of this discoloration suggests the presence of the infiltration of seepage from the surrounding tailings.

- The white and grey residual discoloration is anticipated to be sediment from the impoundment that has infiltrated through cracks in the tower walls.

Figures C-02 and C-03 show specific locations where seepage was occurring and gives an overview of the more relevant areas of tower damage. Sections 2.1.2 and 2.1.3 below give overviews of specific observations in the tower shafts.

2.1.2 South Shaft

Specific observations in the south shaft are as follows:

- Approximately 10 feet below the top of concrete on the west wall, there is a concrete bulkhead blocking a 5.5 feet by 7 feet opening in the main shaft wall. A large volume of water has continuously been observed flowing through the bottom seam between the bulkhead and wall opening. The flow rate out of the seam varies based on surface conditions but is estimated to have be as high as 1,000 gallons a minute. During low flow conditions, grey sediment has been observed on the bottom ledge of the opening (See Photographs 1 and 2 in Appendix B).

- Approximately 28 feet below the top of the concrete, a form board is present at a seam on the east wall. Beneath the form board in the south-east corner of the shaft, water infiltration was occurring at an estimated rate of 2 gallons per minute. A fine, light grey sediment was suspended in the water, and had created a light gray trail of residue down the side of the tower shaft (See Photograph 3 in Appendix B).

was suspended in flowing water when it was deposited. These locations were not observed to be flowing during the inspection (See Photograph 8 in Appendix B).

2.2 Culvert

2.2.1 Culvert Condition

The culvert was in good condition. The concrete was found to be hard when hit with a hammer, indicating overall strength of the concrete was still very high. There were only limited amounts of spalling and general deterioration. The primary observation within the culvert was the presence of efflorescence and hard mineral deposit at culvert seams and some vertical cracks. This observation was made all along the length of the culvert, but generally does not affect the overall strength of the culvert or its functionality. This is described further in Section 2.2.2.

There were several minor cracks along the length of the culvert. There were also two locations where the seams of two sections of the culvert were misaligned. These were at 192 feet in from the culvert discharge and 199 feet in from the culvert discharge.

2.2.2 Mineralization

Calcium efflorescence is caused when water passes through concrete and accumulates concentrations of calcium, which then mineralizes into a solid substance when reaching the surface of the concrete. It is identified by a white crystalized mineral. Efflorescence existed at most of the culvert seams and at some vertical cracks along the length of the culvert. The size of the calcium deposits generally increased and became darker in color as the inspection proceeded toward the tower. The largest deposits were in the south end near the tower chambers.

The presence of iron bacteria and darker discoloration was observed approximately 100 lineal feet from the culvert discharge. It continued to be present at seams and cracks through the rest of the length of the culvert leading to the decant tower. The mineralization varied from surface discoloration to formations that protruded as much as 6 inches from the concrete surface and formed stalactites from seams and fissures in the culvert ceiling (See Photograph 9 in Appendix B).

supported by the observation that mineralization within the culvert was greatest at seams and fissures in the south end of the culvert (the phreatic water surface is believed to decrease along with the centerline of the culvert, gradually reducing hydrostatic pressure to zero near the culvert discharge).

Potential mitigation of sediment infiltration should therefore focus on the decant tower. Potential mitigation of groundwater infiltration should focus on both the decant tower and the culvert cracks and joints.

- **Abandonment of Decant Tower as Primary Drainage Structure**-This option would entail directing surface flow down the spillway channel rather than through the decant tower. Remediation of the decant tower would be limited to the most problematic locations (such as the seam shown in Photograph 1 in Appendix B), and any remaining seepage into the structure would be collected at the culvert discharge and directed to coincide with seepage water surfacing at the toe of the earthen embankment, where a pump station is currently planned for water treatment/water management purposes. This option would require further analysis of surface hydrology/hydraulics, government regulations pertaining to dams, and evaluation of the spillway channel characteristics.

- **Coating of Tower and Culvert Interior**-Products are available which would be applied to the inside of the decant tower shaft and culvert to prevent leakage. This is likely to be a short-term solution and may not be viable due to the ongoing infiltration of water.

- **Coating of Tower Exterior**-The tower could be excavated, and a coating applied to the exterior to seal and protect the tower from infiltration. This could be combined with other approaches to mitigate the issues in the conduit. This is included as a secondary option due to water control and tailings management issues that would likely arise due to excavation.

3.3 Immediate and Future Actions

Barr recommends that DRC proceed to develop preliminary designs and costs for the implementation of the primary options presented in Section 3.1 of the report for the rehabilitation of the towers and culvert.

Appendix B

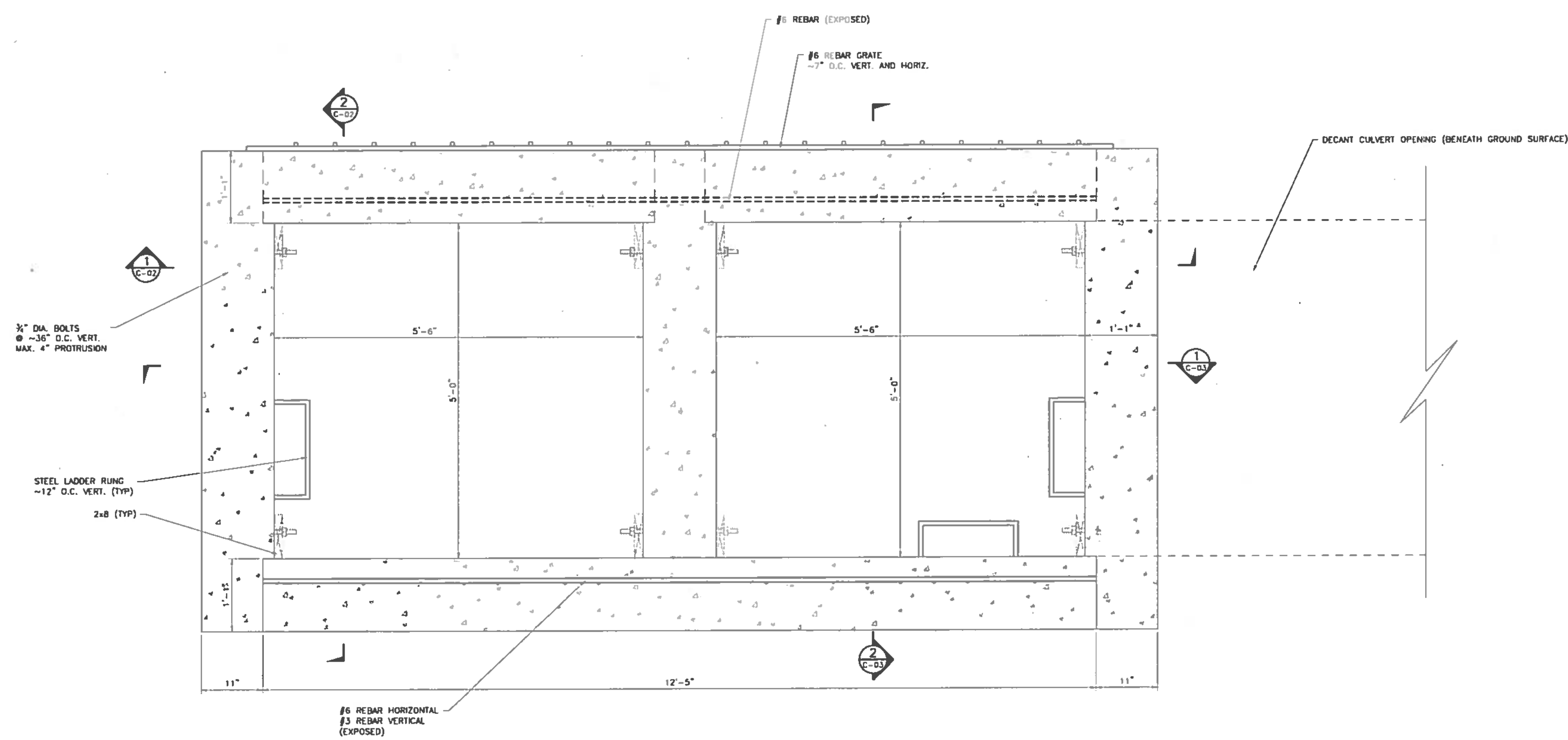
Photograph Log

Photograph 2-Seam at concrete bulkhead, south shaft, looking southwest; red sediment is clay that was used for water control, and was deposited during inspection preparation; gray sediment is assumed to be scouring into the decant structure

Photograph 4-Large gap at seam, south shaft, looking southwest

Photograph 6-Bulkhead interface, north shaft, looking northwest

Photograph 9-Mineralization (iron oxidation and efflorescence) in culvert, approximately 450 lineal feet from culvert discharge, looking southeast



PLAN: DECANT TOWER (1, C-01)

SCALE IN FEET: 0 10 20

PRELIMINARY DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

RELEASED TO/FOR: CLIENT / BID / CONSTRUCTION — A B C 0 1 2 3 — DATE RELEASED

BARR — Project Office: BARR ENGINEERING CO., 3236 EMERALD LANE, JEFFERSON CITY, MO 65109, Ph: 1-888-324-3933, Fax: (573) 638-5001, www.barr.com. Corporate Headquarters: Minneapolis, Minnesota, Ph: 1-800-632-2277

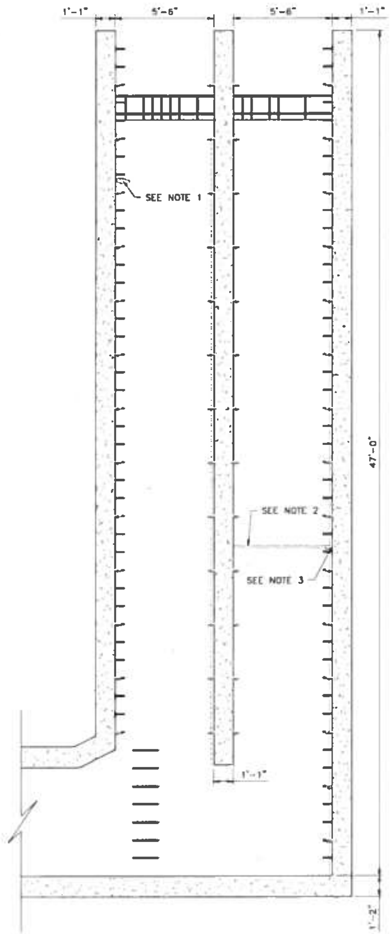
Scale	ST. LOUIS, MO
Date	09/30/13
Drawn	SBM
Checked	
Designed	
Approved	

DOE RUN COMPANY
ST. LOUIS, MO

LEADWOOD DECANT TOWER INSPECTION
LEADWOOD, MO

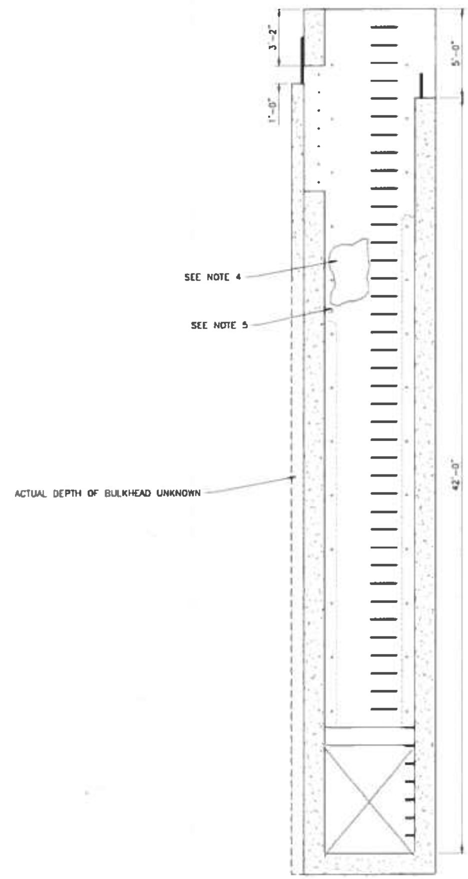
DECANT TOWER SHAFT
PLAN VIEW

BARR PROJECT No. 25861002.00
CLIENT PROJECT No.
DWG. No. C-01
REV. No. 0



1 C-01 SECTION: DECANT TOWER EAST WALL

0 40 80 SCALE IN FEET



2 C-01 SECTION: DECANT TOWER EAST WALL

0 40 80 SCALE IN FEET

NOTES

1. INFILTRATION OF AN ORANGE SEDIMENT WAS OBSERVED HERE. SEDIMENT COLLECTION HAS OCCURRED DOWN THE WALL SEVERAL FEET, AND CONSISTED OF A FINE TO MEDIUM SAND.

2. A FORM BOARD WAS LEFT IN PLACE HERE. THE FORM BOARD IS SLOWLY DECOMPOSING, AND SHOWS DETERIORATION PARTICULARLY AT THE INTERFACE WITH THE CONCRETE AND AT THE ENDS. SEEPAGE WAS OBSERVED AND INCLUDED INFILTRATION OF SEDIMENT

3. SEDIMENT INFILTRATION WAS HIGHEST AT THIS CORNER OF THE FORM BOARD DESCRIBED IN NOTE 2. SEDIMENT WAS WHITE TO LIGHT GRAY IN COLOR AND WAS VERY FINE (PRESUMED TO BE SLIMES). A RESIDUAL TRAIL OF THE SEDIMENT WAS PRESENT FOR SEVERAL FEET DOWN THE SIDE OF THE WALL.

4. THIS AREA CONTAINS SEVERAL POCKETS 4" TO 5" DEEP

5. WHITE RESIDUE WAS OBSERVED LEAKING FROM THIS LOCATION.

PRELIMINARY DRAFT

NO.	BY	CHK.	APP.	DATE	REVISION DESCRIPTION

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BARR
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Scale	AS SHOWN
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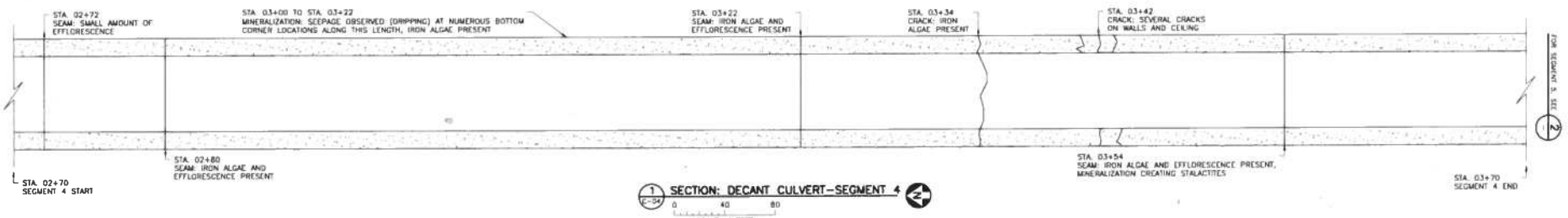
LEADWOOD, MO

LEADWOOD DECANT TOWER INSPECTION
LEADWOOD, MO

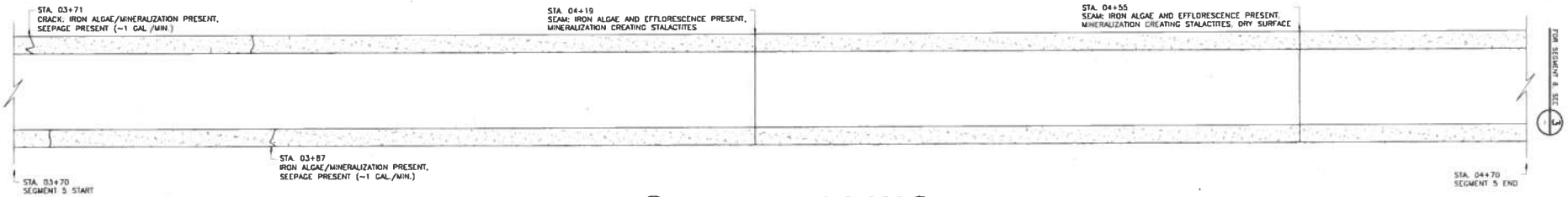
DECANT TOWER SHAFTS
SECTION VIEWS

BARR PROJECT No. 25861002.00
CLIENT PROJECT No.
DWG. No. C-03
REV. No. 0



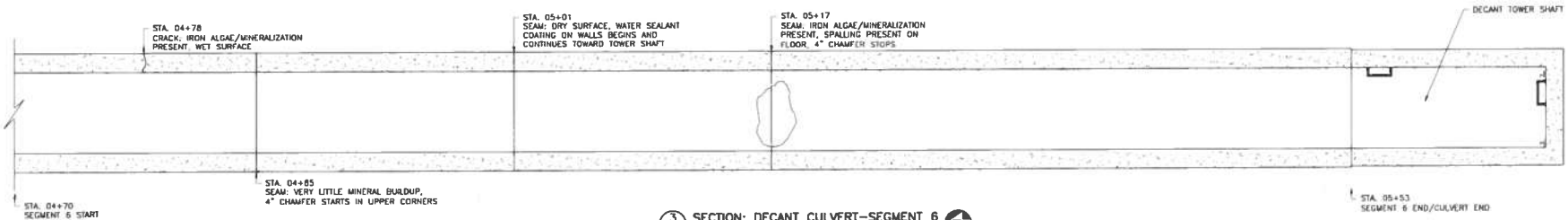
1 C-34 SECTION: DECANT CULVERT–SEGMENT 4 2

0 40 80
SCALE IN FEET



2 SECTION: DECANT CULVERT–SEGMENT 5 2

0 40 80
SCALE IN FEET



3 SECTION: DECANT CULVERT–SEGMENT 6 2

0 40 80
SCALE IN FEET

PRELIMINARY DRAFT

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DOE RUN COMPANY
ST. LOUIS, MO

LEADWOOD DECANT TOWER INSPECTION
LEADWOOD, MO

DECANT STRUCTURE
CULVERT DETAILS

BARR PROJECT No. 25861002.00
CLIENT PROJECT No.
DWG. No. C-05
REV. No. 0